Using ArchiMate to Assess COBIT 5 and ITIL Implementations

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Abstract

The assessment of Enterprise Governance of IT (EGIT) mechanisms, such as COBIT and ITIL, is considered highly complex and implies a duplication of resources. The main goal of this research is to reduce the complexity of EGIT mechanisms by facilitating the assessment of these mechanisms when used simultaneously. Organisational stakeholders should be able to easily understand the impact of implementing ITIL on COBIT 5 Processes Performance without being COBIT experts. On the other hand, they should know their organisation's positioning according to ITIL, even if they just follow COBIT and do not master ITIL. In order to fulfil our goal, we propose a model that uses TIPA for ITIL, COBIT PAM and ArchiMate to analyse the impact of ITIL implementation on COBIT processes performance, and vice-versa. We demonstrate our proposal by analysing the impact of the Incident Management and Request Fulfilment ITIL processes on the COBIT 5 related process.
Keywords: ArchiMate, COBIT 5, ITIL, TIPA for ITIL, Incident Management, Request Fulfilment, Manage Service Requests and Incidents.

1. Introduction

The realization that business involvement is crucial has initiated a shift in the definition of IT Governance toward Enterprise Governance of IT (EGIT) [29].
Several authors argue that organisations should implement EGIT over the use of EGIT mechanisms [29], [32]. EGIT can be deployed using a mixture of various structures, processes and relational mechanisms [4] that encourage behaviours consistent with the organisation's mission, strategy, values, norms, and culture [31].
Examples of process mechanisms are EGIT frameworks, Best Practices and ISO standards. There are many different frameworks which only cover a specific aspect of Information Technology (IT), such as information security, service management, quality, etc. However, while there is no single, complete, off-the-shelf EGIT framework, there are a number of frameworks available that can serve as useful starting points for developing a governance model [28]. Two of the well-known EGIT process mechanisms are Information Technology Infrastructure Library (ITIL) and COBIT 5. They are not mutually exclusive and can be combined to provide a powerful EGIT [13].

COBIT 5 is one of the best known framework regarding the use of technology in support of organisational objectives. Research indicates that organisations are adopting COBIT in practice [3].

In turn, although the exact number of organisations adopting ITIL is not known, there are many indicators of growing awareness and adoption [21]. One of these indicators is the interest in the topic in scientific literature. For example, the paper written by [2] cites the most recent and relevant cases.

According to ISACA [11], COBIT 5 provides a comprehensive framework that assists enterprises in achieving their objectives for the governance and management of enterprise IT. Simply stated, it helps enterprises create optimal value from IT by maintaining a balance between realising benefits and optimising risk levels and resource use.

ITIL is a set of comprehensive publications providing descriptive guidance on the management of IT processes, functions, roles, and responsibilities related to IT Service Management [20]. ITIL advocates that IT services are aligned to the needs of the business and support its core processes. It provides guidance to organisations and individuals on how to use IT as a tool to facilitate business change, transformation and growth.

Therefore, ITIL is primarily focused on design and implementation of efficient processes and procedures for IT Service Management, while COBIT focuses on the content of processes and procedures of IT service management [22].

It means that companies implementing ITIL use IT Service Management principles for managing IT, while companies implementing COBIT use the goal cascade method that maps stakeholder needs into business and IT goals, and these goals are subsequently mapped into corresponding goal of enablers [11].

ITIL and COBIT are highly complementary, and together provide greater value than using just one or the other [10]. ITIL and COBIT 5 have similar objectives that include maximising Return on Investment (ROI), value creation, and IT investment optimisation, leading to achievement of competitive advantage by using advanced IT technologies [17].

In spite of the growing importance of EGIT frameworks and best practices, several problems still remain. For example, COBIT is considered a generic framework [33] and very complex [5], [34]. Additionally, COBIT 5 lacks a visual representation that could help organisations better understand it. Moreover, different frameworks are often used as complementary and, most of the times, simultaneously too. Parallel projects imply a duplication of investments, costs and human resources [6]. In that way, organisations are avoiding to learn, implement and assess different frameworks and best practices at the same time.

Therefore, this research intends to reduce the complexity of EGIT frameworks and best practices' assessment, when different frameworks/best practices, such as COBIT 5 and ITIL, are used simultaneously. In this paper, we present a model that allows organisations to assess Process Capability Level 1 in COBIT 5 and ITIL simultaneously.

IT managers and other key stakeholders should be able to easily know the impact of implementing ITIL on COBIT 5 Processes Performance without being COBIT experts. In the same way, they should be aware of their organisation's positioning according to ITIL's best practices, even if they just follow COBIT and do not master ITIL (it is important to state that we are not saying that an ITIL beginner could perform a COBIT 5 assessment, or vice versa).

In order to achieve our goals we propose to map, model and integrate COBIT 5 Process Assessment Model (PAM) and Tudor IT Process Assessment (TIPA) for ITIL v3 2011 process assessments for the Process Capability dimension level 1, as defined in the ISO/IEC 15504 [15], [16], through the use of ArchiMate as the architecture's modelling language, enabling the integration of these EGIT mechanisms in a standard Enterprise Architecture representation. The Process Capability Level 1 is achieved if a process is performed [1].

By using ArchiMate as the architecture's modelling language for our proposal, we are bringing to this research some of the main advantages of Enterprise Architecture: Technology standardization, process improvement and a visual approach that could help stakeholders have a better picture of the frameworks and best practices used in the organisation.

To sum up, the main goal of this research is to reduce the high complexity of COBIT 5 and ITIL assessment, when used simultaneously. In that way, the understanding of the impact of implementing ITIL on COBIT 5 Process Performance should be facilitated even though organisational stakeholders are not COBIT 5 experts (or vice-versa).

The processes that we chose to demonstrate the mapping and modelling of COBIT 5 and ITIL v3 2011 are the ITIL Incident Management and Request Fulfilment processes, as well as their related process in COBIT 5, which according to ISACA [11] and Karkoskova and Feuerlicht [17] is the Manage Service Requests and Incidents process.

According to Marrone et al. [11], most organisations commence their ITIL adoption with the incident management process. Therefore, we believe that this process and COBIT 5 related processes are the most suitable for the demonstration of this research.
The Design Science Research (DSR) was the research methodology adopted.
The remainder of this paper is organized as follows: In the next section (Section 2) we introduce the research methodology. Afterwards we describe the Problem (Section 3) this research addresses. Then, in Section 4 (Theoretical Background) we describe the approaches that inspired this research. In Section 5 we describe and explain our Proposal. In Section 6 we demonstrate our proposal. In Section 7 we show how we evaluated this proposal. We finish this paper (Section 8) with conclusions about the research as well as contributions, limitations and future work.

2. Research Methodology

Design Science Research Methodology (DSRM) is appropriated for research that seeks to extend the boundaries of human and organisational capabilities by creating new and innovative artifacts. DSRM is also active with respect to technology, engaging in the creation of technological artifacts that impact people and organisations [8].

We can apply this methodology to IT in order to solve organisational problems. DSRM differentiates from other research paradigms because it tries to develop and reach artifacts that can be proven effective in real world scenarios [25]. These artifacts can be categorized in: Constructs, Models, Methods and Instantiations.

Apart from artifacts, DSRM is based on a process which is highly iterative and includes precise methods needed to be done in order to produce and evaluate the artifacts.

There are six steps in the DSRM process [25]. The way that this research fulfilled each step is next described:

1. Problem identification and motivation: A lot of resources (human, capital, etc.) are needed and a high complexity exists when organisations are assessing several EGIT frameworks and best practices simultaneously. (Section 3).

2. Definition of the objectives for a solution: Reduce the high complexity of EGIT frameworks and best practices' assessment, when performed simultaneously (Section 1).

3. Design and Development: We propose an Enterprise Architecture model (represented in ArchiMate) that uses TIPA and COBIT PAM to analyse the impact of ITIL implementation on COBIT's Processes Performance, and vice-versa (Section 5).

4. Demonstration: Demonstrate the proposal by analysing the impact of the COBIT 5 Manage Service Requests and Incidents process implementation in terms of the Incident Management and Request Fulfilment ITIL processes performance, and vice-versa (Section 6).

5. Evaluation: Using appropriate criteria for our research evaluation taken from Prat et al. [26] and the Österle Principles [24] (Section 7).

6. Communication: Submission to the 25rd International Conference on Information Systems Development (ISD 2016).

3. Problem

Despite the growing importance of EGIT in organisations, several problems regarding EGIT frameworks and best practices still remain, which proves that EGIT field has much to evolve further.
IT organisations are facing the challenging, but necessary, transition to manage IT based on business priorities. They are looking to EGIT practices, such as ITIL and COBIT 5, to help them meet the challenge [10]. In fact, their adoption and practice is argued to be the most effective approach and guidance for organisations first considering proper implementation of EGIT [35].

Furthermore, a survey by the ITG Institute revealed that these EGIT practices are among the key enablers for effective EGIT implementation, and that awareness and adoption of EGIT practice relates to the level of EGIT maturity and implementation effectiveness [14].
The implementation of EGIT best practices should be consistent with the enterprise's risk management and control framework, appropriate for the enterprise, and integrated with other methods and practices that are being used [23]. Therefore, management and staff must understand what to do, how to do it and why it is important to do it [23]. However, there seems to be some confusion regarding EGIT frameworks and how best to use them [10].
For example, there is no fully complete framework to be used as a comprehensive off-the-shelf solution to ensure the alignment between service management and the organisation's concepts and artifacts [6]. In fact, different frameworks are often used as complementary and, most of the times, simultaneously too. Parallel projects imply a duplication of investments and costs, and even with shared infrastructures we cannot avoid a duplication of data repositories, procedures and human resources, being hard to define a way for teams not to compete or maintain different efforts aligned [6].
To sum up, having different frameworks to approach governance can lead to several setbacks. In a time when organisations strive to be efficient and effective, it seems counterintuitive to be wasting resources by having different organisational departments handling both approaches independently [30]. In that way, organisations are avoiding to implement different frameworks, in spite of recognising its importance.
As we stated before, the main focus of this research tries to deal with the assessment of several frameworks simultaneously. This is a problem that no one has ever tried to solve as far as the authors are aware. This means that a clear picture of the convergence between COBIT PAM and TIPA for ITIL is still missing, and so, a lot of resources (human, capital, etc.) are required when organisations are assessing COBIT 5 and ITIL at the same time.

4. Theoretical Background

In this section, we describe the main approaches that have inspired us in order to create our proposal.

Interconnecting COBIT 5 and ITIL

Sahibudin et al. [27] propose a comprehensive framework by integrating ITIL, COBIT and ISO/IEC 27002 into an IT framework that they suggest could be used in every company.

However, this approach does not address our problem since it does not take in consideration the current version of both frameworks (the paper was written in 2008) and just maps the processes of both frameworks. Therefore, it does not deepen the other assessment related concepts of both frameworks.
A more recent approach was made by Karkoskova and Feuerlicht [17]. The authors analyse three different practices (ITIL, COBIT and Management of Business Informatics (MBI)) with the objective to identify the relationships between these three practices, in order to map ITIL and COBIT processes with MBI tasks.
According to ISACA [11] and Karkoskova and Feuerlicht [17], the processes that are related with COBIT 5 Manage Service Requests and Incidents process are ITIL Incident Management and Request Fulfilment processes.
All of these approaches do not solve our problem since they have a different scope, since they do not address the assessment of the frameworks.

ArchiMate

The purpose of ArchiMate is to provide a descriptive language for Enterprise Architecture. This language consists of a meta-model describing the various concepts and relationships, as well as a standard notation for them [7].

ArchiMate [18] is a language, in which the service concept plays a central role [18]. The objective of the ArchiMate language is to provide well-defined relationships between concepts

in different architectures, the detailed modelling of which may be done using other, standard or proprietary modelling languages [18]. Concepts in the ArchiMate language cover the business, application, and technology layers of an enterprise and provide an extended layer that represents the motivation. Services offered by one layer to another play an important role in relating the layers [19].

TIPA for ITIL and COBIT 5 PAM

COBIT 5 PAM is a model that aims to assess the capability of a COBIT 5 process. It scales six process capability levels defined in ordinal scale that starts from incomplete to optimizing processes.

TIPA is the result of ten years of research work, including experimentation on combining ITIL with the ISO/IEC 15504. TIPA is a standard-based approach to ITIL (v2, v3 and v3 2011) assessment that can address the challenges (posed by improving the quality of product manufacture or of IT processes) in several important ways, by providing a repeatable, consistent method for conducting process assessment [1].

TIPA for ITIL and COBIT PAM are based on ISO/IEC 15504 [15, 16]. It means that they both rely on the same foundation - ISO/IEC 15504, which is a global reference for conducting process capability assessments. From an assessment perspective, both ITIL and COBIT 5 break down each process into base practices, specific to each process and take into account the generic practices, which are not specific to any particular process.

COBIT 5 base practices are specific to COBIT processes to ensure proper governance and management of Enterprise IT. And TIPA base practices are specific to ITIL to ensure the proper execution of the process in support of the service delivery in line with customer needs.

5. Proposal

In order to assess the impact of ITIL implementation on COBIT Process Performance, and vice-versa, we propose to uniform their representations in order to create a common frame of reference. The use of a common language and a standardized approach oriented towards real business requirements is a key factor, as it ensures that everyone follows the same set of objectives, issues and priorities [23]. In this research we used ArchiMate as our modelling language since it is a language easy to learn and understand [19].

It is important to clarify some aspects of this research:

- Our Stakeholders are people in organisations (such as IT Managers, process managers, organisation's board of administrators) that are going to assess ITIL and COBIT 5 simultaneously.
- This stakeholders have different concerns, more specifically understand the concepts of process assessment and process maturity. In this case, this research addresses the concerns regarding an organisational self-assessment that intends to achieve the Process Capability Level 1, as described in ISO/IEC 15504 [15, 16].

COBIT 5 and ITIL V3 2011 to ArchiMate Ontological Mapping

In order to interconnect COBIT 5, ITIL V3 and ArchiMate it is important to clarify how the different concepts are addressed by each one of them. Taking into account the context of this research we just present the mapping of the concepts that are important to fulfil our research goal (Figure 1). In spite of the fact that several concepts are not explicitly defined in the ITIL glossary (as we can see in Figure 1) they are used in TIPA assessments.

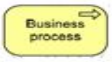
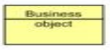
COBIT 5 Concept	COBIT 5 concept description (ISACA, 2012)	ITIL concept	ITIL concept description (ITIL glossary)	ArchiMate concept description (The Open Group, 2013)	ArchiMate Notation
Base Practices	An activity that, when consistently performed, contributes to achieving a specific process purpose. Base practices are the activities or tasks required to achieve the required outcome for the process.	**Base Practices**	Not Defined	A business process is defined as a behavior element that groups behavior based on an ordering of activities. It is intended to produce a defined set of products or business services.	
Process	Generally, a collection of practices influenced by the enterprise's policies and procedures that takes inputs from a number of sources (including other processes), manipulates the inputs and produces outputs (e.g., products, services).	**Process**	A structured set of activities designed to accomplish a specific objective. A process takes one or more defined inputs and turns them into defined outputs. It may include any of the roles, responsibilities, tools and management controls required to reliably deliver the outputs.		
Inputs/Outputs	The process work products/artifacts considered necessary to support operation of the process.	**Input/output**	Not Defined	A business object is defined as a passive element that has relevance from a business perspective. Sometimes, business objects represent actual instances of information produced and consumed by behavior elements such as business processes.	
Process Purpose Statement	A description of the overall purpose of the process. The high-level measurable objectives of performing the process and the likely outcomes of effective implementation of the process.	**Purpose**	Not Defined	A goal is defined as an end state that a stakeholder intends to achieve.	
Process Performance Attribute	A measure of the extent to which the process purpose is achieved	**Process Performance Attribute**	A measure of the extent to which the process purpose is achieved	Something that creates, motivates and fuels the change in an organization	

Fig. 1. COBIT 5 and TIPA/ITIL to ArchiMate Ontological Mapping

Proposed Model for ITIL/COBIT Self-Assessment

In this section we propose a model that illustrates the relationship between COBIT 5 PAM and TIPA for ITIL. It is important to clarify that this model is based on Figure 2, taken from ISACA - Process Assessment Model (PAM): Using COBIT® 5 [12].

Process Performance		
Result of Full Achievement of the Attribute	**Base Practices (BPs)**	**Work Products (WPs)**
The process achieves its defined outcomes.	**BP 1.1.1 Achieve the process outcomes.** There is evidence that the intent of the base practice is being performed.	Work products are produced that provide evidence of process outcomes

Fig. 2. Process Performance (Adapted from ISACA [12])

Therefore, taking into account Figure 1 and Figure 2, our ArchiMate model to perform a simultaneous self-assessment of COBIT and ITIL (in order to achieve the process capability level 1) is the following one:

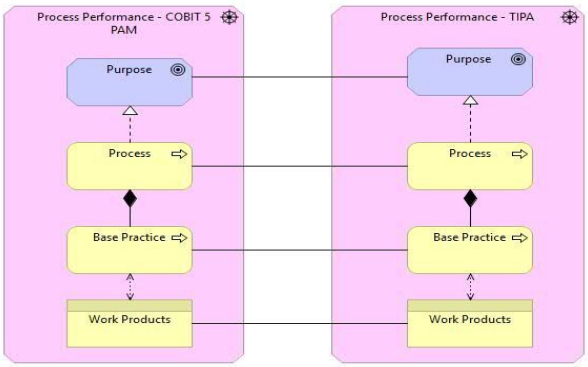


Fig. 3. ArchiMate Model for an ITIL/COBIT Simultaneous Self-Assessment

As we can see in Figure 2, both TIPA for ITIL and COBIT 5 PAM assess ITIL and COBIT 5 using the same concepts. Therefore, we can argue that these two process assessment models are very similar and so, they can be applied for these frameworks/best practices interchangeably.

In Section 6 we instantiate this model, demonstrating it for ITIL Incident Management and Request Fulfilment processes and for COBIT 5 Manage Service Requests and Incidents process.

6. Demonstration

In this Section we use COBIT 5 Manage Service Requests and Incidents process and its related processes in ITIL, which are ITIL Incident Management and Request Fulfilment processes in order to demonstrate our proposal.

In this Section we have just mapped the concepts described in Figure 1.

In Figure 4 we present the mapping of the different processes purpose. As we can see they are rather aligned.

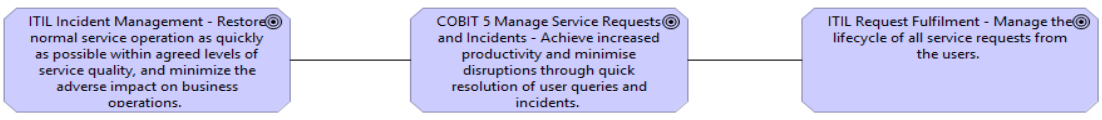


Fig. 4. Processes Purpose

In Figure 5 we present the Base Practices' mapping of the different processes.

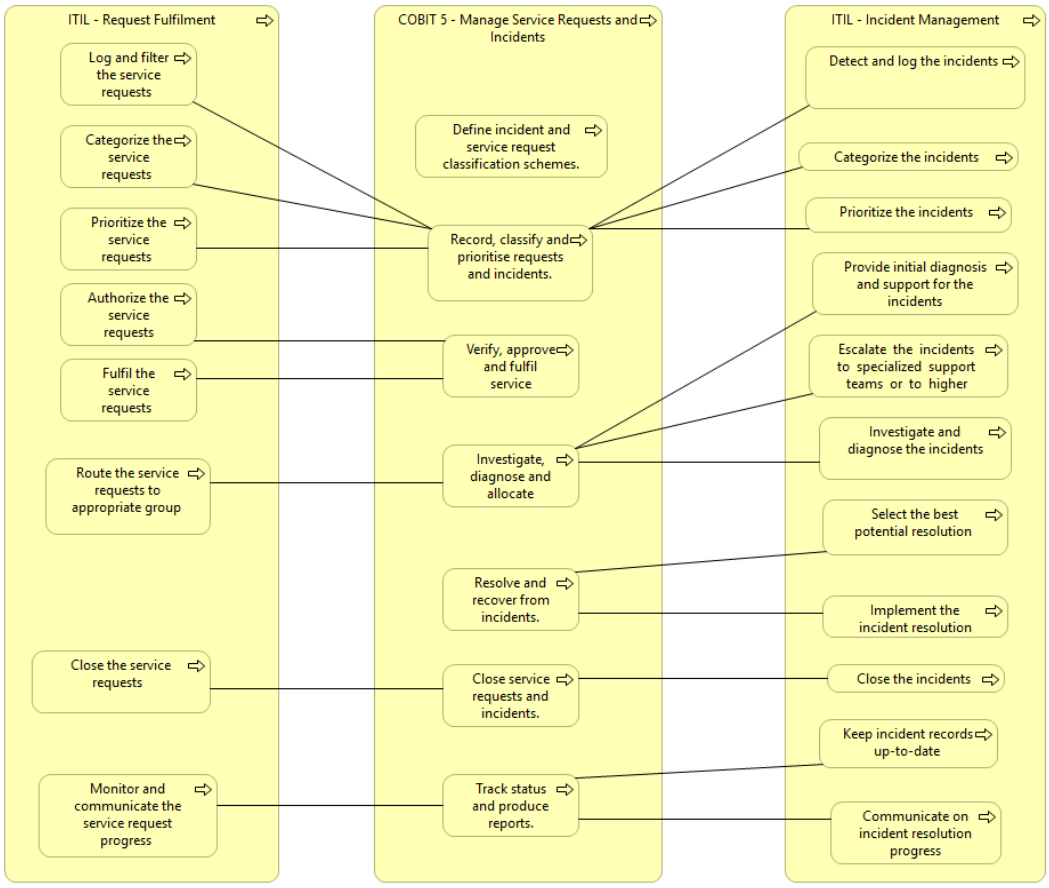


Fig. 5. Base Practices Mapping in ArchiMate

It seems that just one COBIT 5 Base Practice "Define incident and service request classification schemes" has no correspondence in TIPA Base Practices. In our opinion, this situation occurs because this Base Practice has a scope that ITIL does not address. It is a higher level Base Practice, and so, it does not have a correspondent operational Base Practice. All the other COBIT 5 Base Practices seems to be highly related to the Base Practices of the Incident Management and Request Fulfilment processes.

In Figure 6 we present the outputs mappings between the different processes. On the left, we present the outputs regarding the Request Fulfilment process. On the right, we present the outputs regarding the Incident Management process. In the middle, we present the outputs related to COBIT 5 Manage Service Requests and Incident process.

The mapping of the different outputs was a hard task since there is no explicit definition of the different outputs in the official books of COBIT and TIPA for ITIL. Therefore different interpretations could be performed by different people. Therefore, it must be clear that the mapping presented in Figure 6 was developed according to the authors' own experience and expertise.

Several conclusions could be made regarding this mapping. First of all, several outputs have no correspondence. This situation is normal, since the firsts three outputs of COBIT 5 – Manage Service Requests and Incidents are realized in the base practice that has no correspondence in TIPA for ITIL. Moreover, TIPA for ITIL does not address any output related with the Problem Management process. Therefore, the Problem log Output has no correspondence in any TIPA for ITIL Output.

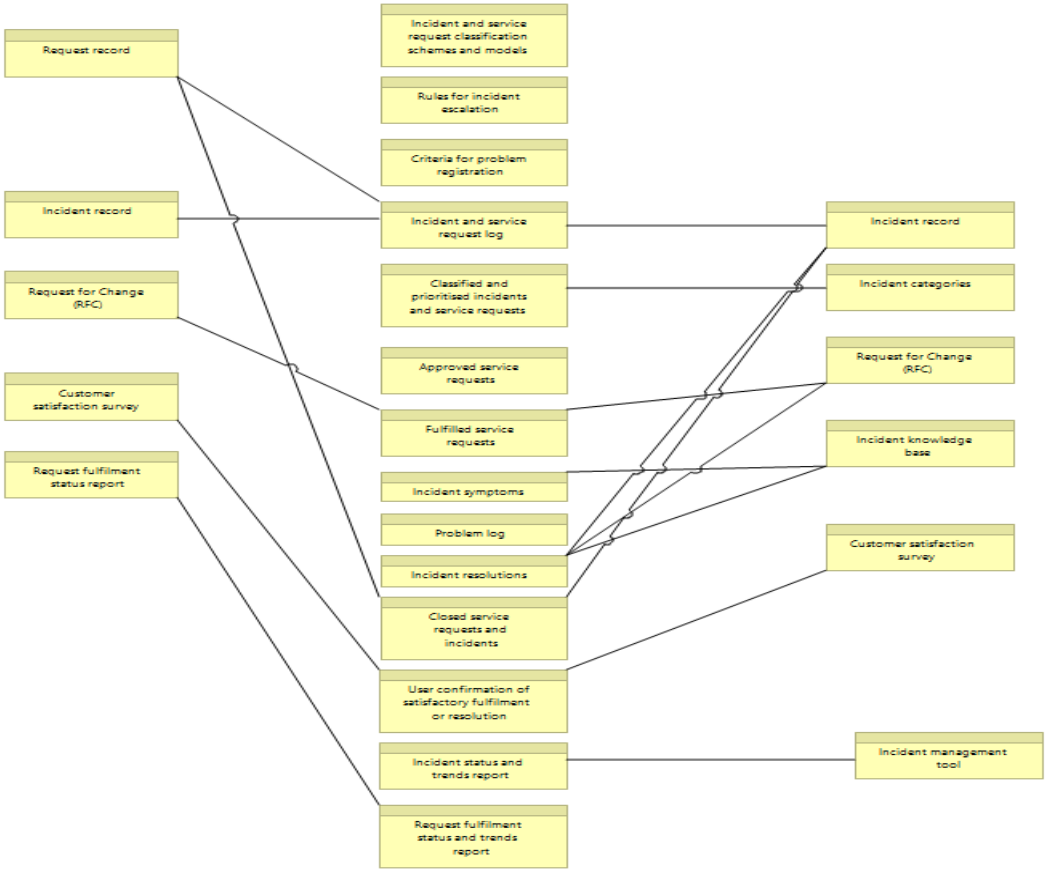


Fig. 6. Outputs Mapping in ArchiMate

In spite of this situation, we can state that the outputs of both practices are highly aligned.

7. Evaluation

To ensure the consideration and validity of this research, in terms of rigor and relevance, we propose the adoption of the DSR paradigm [8] which enables both. Following the DSRM guidelines, the search for a solution to the research problem entails several generating and testing iterations [9], [25]. In this research, we used the Österle Principles [24] and the evaluation criteria proposed by Prat et al. [26] to evaluate this research proposal.

Österle Principles

According to Österle et al. [24], an artifact evaluation can be done through surveys, interviews, experts review or field experiments. In their Memorandum it is specified that one Scientific Research must comply with four basic principles. We fulfilled these principles in the following manner:

Abstraction: The artifact that we propose aims to facilitate the understanding and assessment of two well-known EGIT process mechanisms that are used in several industries.

Originality: The solution is original since it tries to solve a problem that no one has ever tried to solve, as far as the authors are aware.

Justification: The Theoretical Background (Section 4) contributes to the relevance of the principles that underlie this research proposal.

Benefit: Our proposal help organisational stakeholders better understand the impact of implementing ITIL on COBIT 5 Process Performance without being COBIT experts (and vice-versa).

Artifact Evaluation in Information Systems DSR

A recent research [26] stressed that that research on Information Syestems artifacts evaluation remains at an early stage and that in DSR literature evaluation criteria are presented in a fragmented or incomplete manner. The same research [26] provides a holistic view of evaluation criteria and generic evaluation methods to assess the artifacts.

As Prat et al. [26] stated, it is not a critical factor that all evaluation criteria should be used for all artifacts. Researchers should choose the most suitable criteria to their purpose. The chosen criteria and respectively evaluation are presented in Table 1.

Table 1. Research Evaluation

System Dimension	Assessed criteria	Evaluation
Goal	**Efficacy**	The solution facilitates architectural conversations between the Assessment stakeholders and in that way it helps reduce the complexity needed for assessing COBIT 5 PAM/TIPA Process Capability Level 1.
Goal	**Validity**	The solution is valid since it uses the ArchiMate metamodel as Reference Model and also the main COBIT and TIPA for ITIL assessment concepts, taking into account this research perspective.
Environment	**Consistency with people /Utility; Understandability; Ease of use**	The Solution is useful since it provides an architectural representation of ITIL and COBIT 5 and also presents a graphical representation that is easy to understand and it is easy to use in practice [19].
Structure	**Simplicity**	The proposal uses ArchiMate that is a language easy to learn and understand [19].

8. Conclusion

As we stated in the beginning of this paper the assessment of EGIT frameworks and best practices, such as COBIT and ITIL, when used simultaneously, is considered highly complex and implies a duplication of resources.

Therefore, the main goal of this research is to reduce the complexity of EGIT frameworks and best practices, more specifically COBIT 5 and ITIL v3 2011, facilitating in that way the assessment of these EGIT mechanisms simultaneously. IT managers and other key stakeholders should be able to easily know the impact of implementing ITIL on COBIT 5 Processes Performance without being COBIT experts (and vice-versa).

To accomplish this research goal we proposed a model (Figure 3) that demonstrates the similarity between the process assessment models for COBIT 5 and ITIL.

In Section 6 we demonstrated how an organisation could evaluate COBIT 5 and ITIL simultaneously. As we demonstrated, there are a strong similarity between COBIT 5 and ITIL process assessment models regarding Process Capability level 1.

In that way, we believe that this paper helps organisational stakeholders to assess COBIT 5 and ITIL simultaneously even if they just have a deeper knowledge of one of these EGIT process mechanisms.

It should also be stated that this model is useful to create awareness of what should be addressed in order to improve the overall capabilities of a given process.

This research has also several limitations. First of all, we have just demonstrated the suitability of our model for one COBIT 5 process. It is important to demonstrate the suitability of the proposed model to other processes. Moreover, we did not evaluate this proposal in a real organisation. This step is important in order to clarify the practicability of our proposal.

Furthermore, due to space limitations it was impossible to present all the viewpoints

that we have modelled. For example, in this paper we just present the outputs of ITIL and COBIT 5 (we do not present inputs that together with outputs represent the concept of Work Products).

Regarding future work, we believe that in the future some researchers should map, model and integrate other frameworks: for example, COBIT and ISO 27000, ITIL and ISO 20000 and COBIT and ISO 38500.

Furthermore, we believe that a valuable research would be the creation of a glossary for the different inputs and outputs, which are not exhaustive explained, neither in COBIT PAM nor in TIPA for ITIL.

Finally, we believe that an automatic self-assessment tool should be created, in order to provide organisations a useful tool to analyse their process capability in different frameworks and best practices.

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